author is inclined to indorse the suggestions of Packard rather than the hypotheses of Metchnikoff and Boas.

The report on the *Pteropoda gymnosomata* is in some respects disappointing. It was hoped by those interested in these animals that the extraordinary opportunities offered by the 'Challenger' voyage would result in a monographic series of illustrations, giving us satisfactory artistic representations of these exquisite 'sea-butterflies' taken from life. Instead of this, we have a series of diagrammatic plates taken from pickled specimens, and in nearly every case grossly misrepresenting the form and proportions of the living animal. M. Paul Pelseneer, who reports on the group, is evidently quite unacquainted with these animals under their normal conditions of existence, — an ignorance which is not unpardonable, but which has led him into sundry observations which future experience, should he have it, will enable him to modify in the direction of accuracy.

For the rest, considering the chaos which preceded Dr. Boas's monograph, in the *Spolia Atlantica*, in regard to the species, sometimes well figured but poorly described, sometimes unfigured, and sometimes described from immature or mutilated specimens, — considering all this confusion, and finding the characters of form and color familiar to those who know these animals in life, gone irrevocably in pickled specimens, it is not surprising that the author should be disposed to criticise sharply, if not altogether justly, the work of a past epoch. He has brought a certain order out of the confusion, and his work will be helpful to the student of museum specimens. The ideal iconography, which we might have had, of the animals as they live and move, must, however, be looked for from some other direction.

NOTES AND NEWS.

THE government of the province of Cordoba (Argentine Republic) has established a meteorological service, of which Prof. Oscar Doering will be in charge. The new institute will be independent of the national meteorological office which was founded by Mr. Gould. The officers of telegraph and telephone stations will be obliged to make observations in conformity with the instructions. The work will be begun next year on forty stations.

— The first number of the *American Journal of Psychology* will appear early in October. Among the articles which will probably appear in that or the succeeding numbers are the following: 'On Gradual Increments of Sensation,' 'New Methods and Further Results in the Study of the Knee-Jerk,' 'Psycho-Physic Methods and Star Magnitudes,' 'A Criticism of Psycho-Physic Methods and Results,' 'A New Binocular Phenomenon and its Use in Determining the Empirical Horopter,' 'A Review of Contemporary Methods and Results in the Histology of the Central Nervous System in Europe,' 'Paranoia. — A detailed study of a case extending over many years,' 'An Important Study of the Play-Instinct in Children,' 'A Further Study of Heracleitus,' 'An Extended Review of the Work of the English Society for Psychical Research.' The journal will also contain many digests and critiques of current psychological literature, both books and articles.

— The following statistics have been compiled, for the U. S. Geological Survey, by Charles A. Ashburner, principally from the direct returns of the operators of individual coal-mines, supplemented by valuable contributions from State officials. The total production of all kinds of coal in 1886, exclusive of that consumed at the mines, known as colliery consumption, was 107,682,209 short tons, valued at $147,112,755 at the mines. This may be divided into Pennsylvania anthracite, 36,696,475 short or 32,764,710 long tons, valued at $71,558,126; all other coals, including bituminous, brown coal, lignite, and small lots of anthracite produced in Arkansas and Colorado, 70,985,734 short tons, valued at $75,554,629. The colliery consumption at the individual mines varies from nothing to 8 per cent of the total product, being greatest at special Pennsylvania anthracite mines, and lowest at those bituminous mines where the bed is nearly horizontal and where no steam-power or ventilating furnaces are employed. The averages for the different States vary from 3 to 6 per cent, the latter being the average in the Pennsylvania anthracite region. The total production, including colliery consumption, was: Pennsylvania anthracite, 34,853,077 long or 39,035,446 short tons, all other coals, 73,707,957 short tons; making the total absolute production of all coals in the United States 112,743,403 short tons, valued as follows: anthracite, $76,119,120; bituminous, $78,481,056; total value, $154,600,176. The total production of Pennsylvania anthracite, including colliery consumption, was 699,473 short tons in excess of that produced in 1885, but its value was $552,828 less. The total production of bituminous coal was 1,086,408 short tons greater than in 1885, while its value was $3,866,592 less. The total production of all kinds of coal shows a net gain of 1,785,881 short tons compared with 1885, but a loss in spot value of $4,419.420.

— The *Naturwissenschaftliche Rundschau* gives an abstract of J. Coaz's observations on the planerogams first taking possession of the land at the end of retreating glaciers. The end of the Rhone glacier has been marked yearly since 1874, and therefore Coaz made his observations at this place. In the zone left by the ice in 1874, he found 39 species; in the zone following, 37 : 23 species grew in the zone left by the ice in 1876, but then the figures fall off to 12. In the zone of 1881 only 7 are found, and in that of 1881 only a single species. This is *Saxifraga aizoides. Epilobium Fletscheri and Oxyria digyna* grow in all zones except the last. Willows do not occur except in the first two zones. The observations were made in 1883.

LETTERS TO THE EDITOR.

*** The attention of scientific men is called to the advantages of the correspondence columns of* SCIENCE *for placing promptly on record brief preliminary notices of their investigations. Twenty copies of the number containing his communication will be furnished free to any correspondent on request.*

The editor will be glad to publish any queries consonant with the character of the journal.

Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

Scientific Ballooning.

I AGREE most heartily with Professor Waldo, in *Science* for July 15, that "no meteorological data are so much to be desired as those which are now obtained for short, irregular intervals, by balloons." Six years ago, when there was talk of a balloon-voyage from Minneapolis to the Atlantic, I wrote a note regarding the relative importance of the free and captive balloon. I was not then aware that no balloon had ever been kept afloat at a half-mile height more than twenty hours, and then only by the use of about half a ton of ballast. Probably there are now several balloons, in this country, that can be floated more than twenty-four hours by using four hundred or five hundred pounds of ballast each day. The great desideratum in ballooning is a gas-tight envelope. The best record I know of is the suspension of a balloon at about one thousand feet, for thirteen hours, with a loss of about one hundred and sixty pounds of sand. I think an approximation to a tight balloon may be made by increasing the number of coats of varnish, but this would bring about an unwieldly envelope and one likely to crack when emptied of gas.

If we had such an envelope, however, it would be impossible to keep the balloon captive, at a half-mile height, in a wind much over five miles per hour. As the chief investigations we wish to make are during the progress of storms, when the velocity of the current rises to forty and fifty miles per hour, it can hardly be considered that a captive balloon is practicable.

A captive balloon, however, can never give us what we wish; namely, the distribution of temperature, moisture, etc., in a vertical direction, nor in a horizontal stratum. Just the height to which we must go is in some doubt, some authorities placing it at 20,000 feet and over. I think that at least nine-tenths of the disturbance is below 6000 feet, so that the exploration is by no means as formidable as it might seem at first. There is nothing the aeronaut, with a few hundred pounds of ballast, has so completely under his control as an up-and-down movement, and he can satisfy the most enthusiastic observer with all he may wish of such movement. The weight of an observer, perhaps, is the least objectionable point in ballooning. In most cases at least two men are taken, together

with a few hundred pounds of sand. If the envelope were absolutely tight, this would be ample for several ascents to 10,000 feet, or to keep the balloon in suspension many days. Nothing of scientific accuracy can be had at a high level without a practised hand on the spot. Questions of exposure of instruments, observations of clouds, etc., demand an immediate answer at each record, if we desire valuable observations. Glaisher made thousands of observations of the moisture-contents of the air in his memorable scientific ascents, but, though these have been utilized by others in doubtful computations, he himself does not summarize them in considering his results. All who have tried to make humidity-observations in a room, with no air stirring (which is precisely the condition in a balloon), know how exceedingly unsatisfactory they are.

I believe that the investigations needed may be made at an expense much less than is ordinarily supposed. There is needed a balloon of about 60,000 cubic feet capacity (a larger one would be too unwieldy, and is not necessary for ascents up to 20,000 feet). The gas for inflation should be the last that comes in the process of manufacture: this is poor in illuminating power, because it has less carbon, but it is nearly one-fourth more buoyant than ordinary coal-gas. This is not exactly a refuse product, yet it can be had very cheaply. It would be a most excellent plan to send up four balloons at once, about two hundred miles from the centre of a storm, in the north-east, north-west, south-west, and south-east quadrants. But, as this would be rather expensive, we must explore the most interesting point first. I would send up the balloon either to the south-west or west of a storm: at a height of 6,000 feet, it would, in all probability, outstrip the storm, and the descent could be made either in the centre or a little to the east of it. We could then either make another ascent immediately, or wait till the storm has passed overhead, and then make another trip just as at first. This will enable us to determine, not only the vertical distribution of temperature and moisture in the neighborhood of the storm, but also the action, whirling or otherwise, that takes place at the seat of the storm, or where the 'power' of the storm is developed. When the balloon is no longer able to rise, a fresh supply of gas may be carried to it in a small balloon, or in a long flexible cylinder (as suggested by Professor King). If near any gas-works, the balloon may be towed near enough to obtain a fresh supply. As about 30,000 feet of gas would be needed to float the balloon and all its appliances, it will be seen that this would effect a great saving. I understand perfectly that carrying out such suggestions as these may be a very difficult matter in practice, and often impossible in a high wind. For ten thousand dollars, I think, fifty or sixty ascents might be made, which would be of incalculable importance in the study of the origin, development, and progress of storms. Such investigation is absolutely necessary if we would advance our knowledge of the generation of storms. Any advance in this direction is of such moment to almost all classes of people, especially to farmers and mariners, that we may hope such a small sum will be volunteered, or obtained from government, ere long for this study. H. ALLEN HAZEN.

Washington, D.C., July 19.

Cloud-Heights.

THE following method, which can often be used to determine the elevation of certain clouds, may interest some of your readers, particularly topographers and meteorologists.

I was watching to-day, from Little Monadnock, the shadow of a dense cumulus moving slowly along the southern slope of Monadnock, until finally the edge touched the hotel about half-way up the mountain. It occurred to me, that, if the point where I stood and the hotel were plotted on a plane-table sheet, and the sheet oriented, the elevation of the cloud could easily be found in this way At the moment the shadow reaches the second plotted position, draw, through the station occupied by the observer, a line, and read a vertical angle to the edge of the cloud that casts the shadow. Then, through the second plotted position, draw a line in the direction of the sun. The point of intersection of these two lines is the horizontal projection of the position of a point on the edge of the cloud at the time the shadow has reached the second plotted position. The distance (to be scaled from the map) from this intersection to the point occupied, is the base, and the vertical angle of elevation the adjacent angle of a right-triangle, of which the altitude is the height of the cloud above the observer. This may be corrected for curvature and refraction.

When a plane-table sheet is nearly complete, with many located points on it, the same cloud may be observed several times, and the determinations of altitude compared.

This method is extremely simple, and I am very anxious to have it tried. I shall not be able to do this myself for several weeks, but I hope some one who is working with a plane-table will, and let me know his results. H. L. SMYTH.

Dublin, N.H., July 2.

The Wholesomeness of Swill-Milk.

THE discussion carried on in the pages of *Science* for some weeks past upon the healthfulness of milk from cows fed upon distillery-swill has, in my opinion, failed to definitely settle the question. There can be no doubt of the vital importance of the matter, and all physicians and sanitarians will agree that a solution of the problem is highly desirable.

1. I venture to say that no positive evidence has been submitted showing any ill effect of swill upon cows fed with it. The evils attributable to it are largely, if not entirely, to be ascribed to the unsanitary surroundings of the animals.

2. Whatever evidence has any positive value indicates that swill is equally as good and proper food (used with judgment) as hay, dried fodder, ensilage, or bulbous roots. These all differ widely in chemical composition from the green foods (grass, clover, green oats, and corn), which may be looked upon as the normal food of cows.

3. It may be worth while remembering that lactation in a dairy is not a normal process. Dairy-cows are 'milk-machines.' The dairy business would not be very profitable if lactation were not forced to some degree.

4. Experienced agriculturists, like Professor Armsby and Dr. Sturtevant (*Science*, ix. pp. 602–3), have failed to see any ill effects attributable entirely to swill, and such veterinarians of ability as Professor Law and Dr. Salmon (*Ibid*, p. 552) corroborate this testimony.

5. The facts collated by Professor Brewer (*Ibid*, p. 550), showing the ready absorption of germs and odors by milk, the transmission of the flavor of various odoriferous substances eaten by the animal to the secretion, the passage of certain drugs administered medicinally into the milk of nursing women, or the notorious fact that swill-milk stables are 'proverbially foul and stinking,' have no bearing upon the case. The evidence required to establish the unwholesomeness of swill as food for milk-giving animals must be of a different character.

6. While it may be conceded that 'chemical analyses will not settle the question' of the wholesomeness of swill-milk, the fact remains that we have at present no other way of determining the physical qualities of a specimen of milk. Bacteriological investigation may determine the presence of the germs of tuberculosis, typhoid, and, in view of recent discoveries, of scarlet-fever, but will not enable us to ascertain the relative proportions of saccharine, fatty, aqueous, or proteid matters present. Chemistry is here still our main-stay, and, other things being equal (more definitely, disease-germs being absent), a specimen of milk nearly approaching the chemical standard established by Kœnig may be looked upon as a wholesome food. Other factors besides the food of the animal enter into the production of milk. The age of the animal, period of lactation, time when the milk is drawn, and general sanitary condition, must not be ignored.

7. The asserted greater firmness, and consequent indigestibility, of the coagulum in swill-milk is not based upon a sufficient number of observations to admit of unquestioned acceptance. It should be easy to determine this in any chemical laboratory. No single series of observations would decide this, however. It would be necessary to test milk from cows fed upon swill but kept under good sanitary conditions, side by side with milk from animals kept under the ordinary conditions of city stable-life, and fed upon various foods.

8. A scientific solution of the question will not be furthered by